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PATENT ABSTRACTS OF JAPAN

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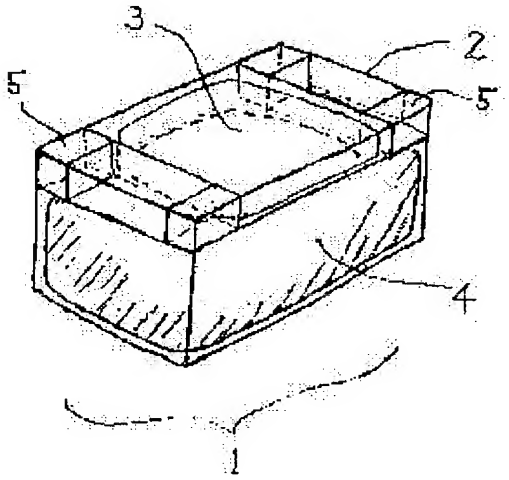
(71)Applicant : **KINOSHITA TERUO**
(72)Inventor : **KINOSHITA TERUO**

(54) SUBMERSIBLE TANK BARGE AND ITS CARRYING METHOD

(57)Abstract:
PURPOSE: To store a large volume of water and fluid-like substance, and carry it for a long distance at low cost by making use of the current by storing an expandable cargo tank of variable capacity in the lower part of a submersible tank barge.
CONSTITUTION: Buoyancy is generated as the loading (water loading) is started because there is difference of about 0.03 in the specific gravity between the sea water and the pure water. The large buoyancy of a cargo tank 4 in the full load condition and the small buoyancy of a balance tank 5 are set to be slightly larger than the weight of the barge. Thus, the buoyancy of a buoyant tank 3 is dispensed with in the full load condition, and the air is released by a release valve. That means, the afloat condition where the barge in the full load condition is afloat on the sea surface is obtained without the buoyancy of the buoyant tank 3. After the loading is completed, the air in this balance tank 5 is released, and at the same time, a sea water valve is opened to introduce the sea water and to reduce the buoyance, leading to the submersion of the fully-loaded barge at about 30m below the sea level.



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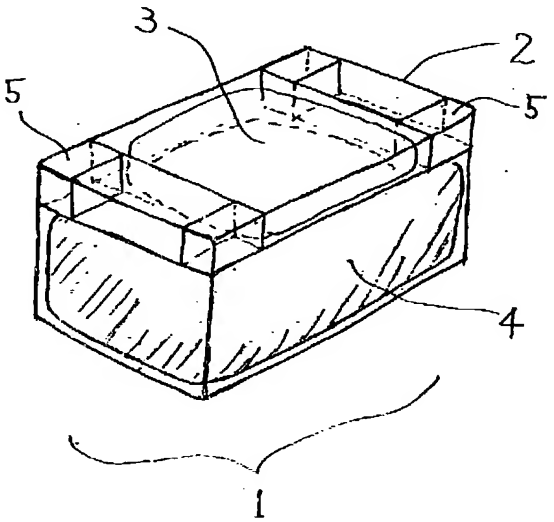
(54)【発明の名称】　潜水式タンクバージ及び輸送方法

(57)【要約】

【目的】海に於いて大量の水や流体的物質を安価に輸送する装置を提供する。

【構成】枠組構造体と、それの内部空間に納まる可変容量の伸縮性浮力タンク、貨物タンク及びバランスタンクを主要構成要素とし、載荷時は貨物に基ずく貨物タンクとバランスタンクの浮力が、また空荷時は浮力タンクとバランスタンクの浮力が自重に釣り合い、即ち海面に浮状し、さらにバランスタンクの浮力を調整することで、自体を浮上又は潜水させ、潜水状態で海流に任せて移動し、荷役は海面で、空荷回航は潜水状態で他船に曳航される潜水式タンクバージとこれによる輸送方法である。



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【特許請求の範囲】

【請求項１】枠組構造体とこの内部上部に納まる可変容量の伸縮性浮力タンク及び剛性バランスタンク、内部下部に納まる可変容量の伸縮性貨物タンク、荷役設備、浮力調整制御装置（気蓄タンク、水圧センサーを含む）及び通信信号装置で構成し、通常は載荷状態の貨物タンク又は注気状態の浮力タンクの浮力と、バランスタンクの浮力とにより浮状状態を保持し、かつバランスタンクの浮力の調整により載荷状態及び空荷状態での潜水及び浮上を行うこと、浮力タンクへの浮力調整の注気を曳航用タグボートから行うこと、及びバランスタンクへの浮力調整注気を気蓄タンクから行うことを特徴とする潜水式タンクバージ。

【請求項２】載荷時に海流に潜水して移動し、空荷時にタグボートが回航曳航することを特徴とする潜水式タンクバージによる輸送方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、海に於ける水輸送の装置に係わり、詳しくは、屋久島から多量（数万トン）の川水を本州の臨海都市へ、黒潮海流中に潜水して輸送する装置及び輸送方法。

【０００２】

【従来の技術】海で水を運ぶにはいわゆるタンク船（水タンカー）が使われるが、せいぜい数百トン程度である。万トン単位の大量の低価格の水を遠距離間運ぶには大型石油タンカーと同様な方式が考えられるが、船価がかさみ、また、運航経費即ち、人件費や運航時の燃料費を必要とするなどコスト上の問題がある。

【０００３】

【発明が解決しようとする課題】本発明は満載載貨状態で海流（黒潮）に潜水して、推進動力装置を使わずに水を大量、安価に運ぶ装置及びこの装置とタグボートからなる方法を提供することである。

【０００４】

【課題を解決するための手段】枠組構造体とこの内部上部に納まる可変容量の伸縮性浮力タンク及び剛性バランスタンク、内部下部に納まる可変容量の伸縮性貨物タンク、荷役設備、浮力調整制御装置（気蓄タンク、水圧センサーを含む）及び通信信号装置で構成し、通常は載荷状態の貨物タンク又は注気状態の浮力タンクの浮力と、バランスタンクの浮力とにより浮状状態を保持し、かつバランスタンクの浮力の調整により空荷状態及び載荷状態での潜水及び浮上を行うこと、タンクへの浮力調整の注気を曳航用タグボートから行うこと、及びバランスタンクへの調整注気を気蓄タンクから行う潜水式タンクバージであり、そして、空気圧送装置等を備えたダグボートから曳航用ロープ及び注気パイプ、信号・動力線等で繋いであり、バージの制御、即ち浮力タンクに空気の注入等が可能であり、載荷時に海流に潜水して移動し、空

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荷時も潜水したタンクバージをタグボートが回航曳航する潜水式タンクバージによる輸送方法である。

【０００５】

【作用】前記のような構成のタンクバージにおいて、貨物タンクに貨物である水が入っていない空荷の時、伸縮性貨物タンクは収縮しており、浮力タンク及びバランスタンク内の空気に基ずく浮力とバージの構成部材自体の固有浮力の合計が、バージ自重と釣り合って海面に浮かぶ、浮状状態になる。

【０００６】バージ自重からバージ自体の固有浮力を差し引いたものを、見掛け自重（以下自重とは見掛け自重を意味する）とすれば、この自重より、浮力タンクとバランスタンクの合計浮力を大きくしておくことで、バージは海面に浮状状態になる。

【０００７】水をバージに積む荷役の場合、水タンクへの注水（積み荷）につれそのタンクは下方向に伸長、拡大する。同時に海水と積荷である水との小さい比重差（約０．０３）のために浮力が生じる。そして満載状態で、この大きな貨物浮力とバランスタンクの小さな浮力がバージの自重とほぼ釣り合って海面に浮状出来るようにしてある。これは、満載時に貨物浮力が浮力タンクの浮力の肩代わりを出来ることであり、従って浮力タンクの浮力は余分となり、潜水を妨げるので、浮力タンク内の空気を放出することになる。

【０００８】そして、浮状状態の満載バージを、バランスタンクの空気量、即ち浮力を減らすことで、海面下約３０ｍに沈め、そのまま海流に任せる。推進用動力装置が無く燃料不要である。この水深を保持すれば海上を航行する船との衝突は無く安全である。目的とする臨海都市近海域に到達すればタイマー自動作動又はタグボートからの操作指示による浮力調整制御装置の作動で、即ち高圧気蓄タンクからバランスタンクへ空気を送り浮力を増し、海面に浮上する。さらに浮力タンクにもタグボートから空気を満たし、浮力を付加してから、荷役即ち揚水する。

【０００９】揚水終了後、バージは空荷状態になり貨物浮力を失い、浮力タンクとバランスタンクの浮力により浮状している。このタンクバージを、バランスタンクから一部空気を放出することで再び海面下５ｍ以下に沈める。沈むに従って増加する水圧による浮力タンクの体積、即ち浮力が減少するが、これを防ぐため、この時も浮力調整制御装置の作動で、タグボートから注気パイプにより空気を浮力タンクに注入し、タンク内の圧力を高め、以後その体積（浮力）をほぼ一定に保持する。そして潜水した空荷バージを、海上からタグボートが水源地である屋久島まで曳航する。以後、同様な作動の繰り返しで安全、安価に水を輸送する装置及びシステムである。

【００１０】

【実施例】以下、本発明の潜水式タンクバージ及び輸送

システムを図１～７図に基いて説明する。図１のように、潜水式タンクバージ１は鋼製の枠組構造体２と、フレキシブルな、伸縮性浮力タンク３、伸縮性貨物タンク４及び剛性バランスタンク５を基本構成要素とする。

【００１１】図２のように、枠組体２は鋼材で直方体状をなすラーメン・ブレース式構造体である。形鋼、有孔鋼板、ブレース等で上層平面６を構成し、さらにこの上層平面の下側に、ある間隔をおいて同様の中層平面７があり、枠組構造体２を上部空間８、下部空間９に分ける。この枠組体２の上部外周面８ａには網状面材１０が全周貼られており、従って内部への海水の出入りが自由である。下部外周面９ａには中層平面７と底部１１の水平外周枠材１１ａとの間に、適正な水平方向の間隔をおいて鉛直状に接合される複数のタンクガイド１２が平行に並ぶ。底部１１は形鋼等で格子状の平面を構成し、ブレース等で補強する。

【００１２】図３のように、このタンクガイド１２は、二本の形鋼１３を平行に小隙間離し対称的にコの字状に配置し、小隙間１４を含む側を枠組体の内側に向けて、前記のように中層水平枠材７ａ，底部水平枠材１１ａに接合される。このようなタンクガイド１２が枠組体の下部外周面９ａに適正な水平方向の間隔で平行に幾組も鉛直に並ぶ。そしてこれらタンクガイド１２の外側に適正な間隔で幾段もの水平補強材１５が接合される（図２）

【００１３】図２に示したように、このように構成された枠組構造体２の上部空間８の大部分を偏平な浮力タンク３が占め、この空間の四つの隅角部、即ちバージ上部の四つのコーナー部１６を小容量の剛性バランスタンク５が占める。図４に示すようにこのバランスタンクは高圧気蓄タンク１７と結ぶ連結パイプ１８と空気バルブ１８ａ、及び海水の出入りする海水バルブ１９が付く。

【００１４】下部空間９に貨物タンク４が納まる。このタンクは、プラスチック又はゴムの膜で作られ、フレキシブルかつ上下方向に伸縮自在であり、空気または水が満たされると伸展し、直方体状になる。

【００１５】貨物タンク４の外周側面２０には、長円球状の突起２２が適正な間隔で上下方向に列をなし、この突起の列が平行に並ぶ。この突起列２２ａが、それぞれ前記タンクガイド１２と上下方向に滑動するように係合する。（図３）

即ち突起列２２ａがコの字状のガイド内凹部２３に納まり、隙間１４を抜けることがなく、タンク側壁がガイド１２から離れることを抑えることになる。これにより貨物タンクの上下方向の伸縮が自由に行われ、空の時にその外周側面２０が内側に折れ重なることになり、その底面２１が中層平面７に下から接近して収縮し偏平状になる（図５）。また注水・揚水や移動・航行時に不規則な変形（突出、陥凹）を防止される。そして貨物タンクの収縮をよりスムーズに行うためにタンク底面２１に薄い空気層<図示せず>を付け、この浮力でタンク底面を押し揚げることもよい。

【００１６】また貨物タンク４は枠組体の中層平面と接触状態であり、強固に接合はされてなく、フレキシブルな注揚水管２４及び注揚水バルブ２４ａを介して繋がっている。（図４）

【００１７】以上の様な基本構造とするタンクバージ１は、図６に示すように空荷の時、大きな浮力タンク３に空気を空気圧送装置を備えたタグボート２５からの注気パイプ２６、注気バルブ２６ａを介して注入し、小さなバランスタンク５には高圧気蓄タンク１７から注気し（図４）、これらの浮力を自重より大きくすることで海上に浮かぶ、浮状状態にする。なお高圧気蓄タンク１７は潜水前にタグボートから高圧空気が充填されている。この状態で貨物である水を陸上から、注揚水管２４及び注揚水バルブ２４ａを介してタンクに注入することになる。

【００１８】海水と真水の比重差が約０．０３あるため、荷役（水注入）につれて浮力を生じる。満載状態での貨物タンク４の大きい浮力とバランスタンク５の小さい浮力がバージ自重より少し大きくしてある。従って満載状態では浮力タンク３の浮力は不要となり、排気バルブ２７により空気を放出する（図４）。即ち、浮力タンク３の浮力が無くても満載状態のバージが海面に浮かぶ、浮状状態になる。

【００１９】荷役完了後満載バージを、バランスタンク５の空気を放出バルブ２８で放出し、同時に海水バルブ１９を開き海水を導入する（図４）。即ち浮力を減すことにより、海面下約３０ｍまで潜水させる。これらバルブを閉じる。そしてそのまま海流により移動してゆくことになる。この水深を保持すれば、荒天時の波浪の影響をほとんど受けず、また海上を航行する船との衝突はなく安全である。目的の臨海都市近海域に到達すれば、タイマー作動又はタグボートからの操作指示で、高圧気蓄タンク１７からバランスタンク５へ連結パイプ１８と空気バルブ１８ａを介して空気を送り、同時に海水バルブ１９が開き海水が押し出され、浮力を増してからこれらバルブは閉じ、海面に浮上してゆくことになる（図４）。

【００２０】タンクバージから陸へ注揚水管２４及び注揚水バルブ２４ａを介して揚水する場合、貨物浮力が減少して行くので、浮力タンク３に空気を充分注入し、最大浮力を付けてから揚水を開始する。揚水につれて貨物タンクは収縮し、揚水終了後、貨物浮力を失うので、空荷状態のバージはバランスタンク５の小さい浮力と浮力タンク３の大きな浮力により浮く、浮状状態になる。

【００２１】この状態でバランスタンク５から空気を、放出バルブ２８で放出し、同時に海水バルブ１９を開き海水を導入すれば、浮力が減少し潜水を開始し、空気の放出量を調整して海水バルブ１９を閉じれば、水深５ｍ以下に停留する。この時増加する水圧によるフレキシブ

ルな伸縮性浮力タンク３の浮力、即ち体積の減少を防ぐため、ダグボート２５より注気パイプ２６及び注気バルブ２６ａを介して空気を浮力タンクに注入し、タンク内の圧力をその水圧とバランスさせ、以後その体積（浮力）をほぼ一定に調整し水深を保持する。

【００２２】潜水前にダグボート２５にロープ（乃至鎖）２９、制御用信号線・動力線３０及び注気パイプ２６で繋いでおき（図６）、そしてこのまま海上から、水源地である屋久島へタンクバージを曳航する輸送方法である。潜水したタンクバージには高波の影響が不安定要因となり、即ち高波により水深、水圧の増加がフレキシブルな浮力タンク３の圧縮、浮力減少をもたらし、バージの一層の沈下を生ずる。この場合も前記と同様に、ダグボート２５から注気パイプ２６により空気を浮力タンク３に注入し浮力を保持する。一方、貨物タンク４は収縮しており、水抵抗は小さく、燃費は小さい。

【００２３】満載状態で潜水しているバージの水深と水平姿勢の保持には、バージの四コーナー部１６の水圧センサー３１の測定する水圧をもとに各々のバランスタンク５の空気量、イコール浮力を夫々調整することにより行う。

【００２４】水深は、各水圧センサー３１の測定水圧を処理して、各バランスタンクの空気バルブ１８、放出バルブ２８及び海水バルブ１９の開閉を制御する水密耐圧性浮力調整制御装置３２により制御する（図４）。即ち、水深は少なくとも四隅にある水圧センサー３１により測定し、タンクバージ１が約３０m沈むと高圧気蓄タンク１７からバランスタンク５へ連結パイプ１８、空気バルブ１８ａを介して自動的に送り込まれる。同時に海水バルブ１９が開き海水が押し出され、浮力を増してからこれらバルブは閉じ、その水深を保持する（図４）。この浮力調整制御装置３２は、すべてのバルブの開閉制御を行い、バージの状態を微調整し、またタグボートからの有線又は非有線遠隔操作及び自動作動への切り替えが可能である。（図７）

【００２５】また姿勢の水平保持や波浪の影響も、バージの四コーナー部の水圧センサーが測定する各水圧の一定時間平均値の差で、タンクバージの傾きを浮力調整制御装置３２が検出し、四個のバランスタンク５の空気量を調節することでタンクバージを水平に保持することになる（図４）。

【００２６】空荷状態で潜水しているバージの水深の保持も、上記

【００２４】のように浮力タンク３への空気注入、また水平姿勢の保持にも、

【００２５】と同様に四個のバランスタンク５の浮力の調整で行う。

【００２７】以上は枠組構造体に貨物タンク１個を納めた場合であるが、複数個の貨物タンクを納めてもよく、この場合略長方形の枠組構造体の長手方向に並べる。タンクガイドは下部外周部のみならず各貨物タンクの間にも、上記とほぼ同様に設置される。更に枠組構造体の形状は直方体状に限定されず、円柱、楕円柱状でもよい<これらは図示せず>。

【００２８】なお、設定貨物容量が比較的小さい場合、自重が相対的に大きくなるが、この場合付加浮力を考慮する。また貨物タンクの設定容量が小さい（数千トン）場合は、枠組構造体の下部構造（タンクガイドも含め）は無くともよい場合がる。これはバージの自重が減ることであり、場合によっては前記の付加浮力の配慮が不要になる。

【００２９】浮力タンクへの空気注入はタグボートから行う方式の他に、バージにシュノーケル式ディーゼル駆動空気ポンプを備えても良い。バランスタンクの浮力の調整において、空気を海中に放出せずに、この空気を高圧気蓄タンクへ圧送する方式でもよい。またバランスタンクへもタグボートから空気注入する方式もよい。なおタグボート側の関連装置（バージの搭載諸機器の遠隔操作装置、通信、曳航等）、また浮力制御、信号通信、航行、荷役、曳航、係留等の諸装置の詳細は省略する。

【００３０】また、浮力タンクは、非弾性的な柔軟な材料、例えば布地にゴム又はプラスチックを接着、含浸させたものとし、タンク内を連通性の隔壁で多数区画しておけば、空気を浮力タンクに注入、加圧してもほぼ一定の偏平形状となる。従って、潜水深度の圧力に相当する以上の圧力まで加圧しても、タンク全体の形状と体積はほぼ一定である。この加圧状態で潜水し、予定潜水深度に達してもタンクは水圧により圧縮されず、即ち浮力を一定に保つことになり、一定深度を保持しやすくなる。この場合はもちろんダグボートから空気を浮力タンクに注入することを必要としない。

【００３１】さらに、浮力タンクは必ずしもフレキシブルでなくとも、これが納まる上部空間を水圧によりほとんど変形しない鋼製の浮力タンクとしてもよい。そしてこの非フレキシブタンクを枠組構造体の側面、タンクガイドの外側に設けてもよい（潜水艦方式）。ただし、これらタンクは空気用バルブの他に海水用バルブも必要とする。

【００３２】本発明に関連する出願に、名称を「水上輸送の装置及び方法」として、・特願平　４－３３０８８０、　・特願平　４－３６２０８３、　がある。

【００３３】

【発明の効果】枠組構造体とそれの内部空間に可変容量の浮力タンク、四個のバランスタンク、貨物タンクを納めて構成される潜水式タンクバージは、大量の水や流体的物質を収容し、海流を利用することで、遠距離を安価に輸送することが出来る。さらに、海中を移動するので、他の船の航行を妨げず安全であり、かつ波の影響が少ないので、構造が簡素で良く、建造コストが低くなり、そして空荷時に貨物タンクは収縮し、タグボートに

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よる回航曳航の燃費が小さい輸送方法である。またこのバージは移動せずに水や比重約１の流体の貯蔵装置として利用も可能である。

【図面の簡単な説明】

【図１】本発明の潜水式タンクバージの斜視図である。

【図２】本発明の潜水式タンクバージの詳細斜視図である。

【図３】本発明の潜水式タンクバージのタンクガイド斜視図である。

【図４】本発明の潜水式タンクバージの上部の内端部詳細斜視図である。

【図５】本発明の潜水式タンクバージの貨物タンクの収縮状態断面図である。

【図６】本発明の潜水式タンクバージ輸送方法の空荷状態及び満載状態の潜水曳航及び移動状況を示す。

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【図７】本発明の潜水式タンクバージの制御関連図である。

【符号の説明】

１　潜水式タンクバージ　　２　枠組構造体　　３　浮力タンク

４　貨物タンク　　５　バランスタンク　　１２　タンクガイド

１７　気蓄タンク　　１８　連結パイプ　　１８ａ　空気バルブ

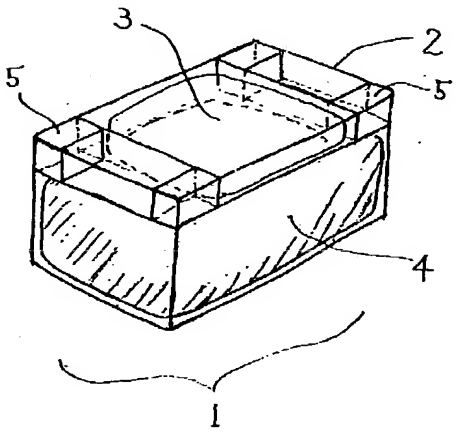
１９　海水バルブ　　２２　突起　　２２ａ　突起列

２５　タグボート

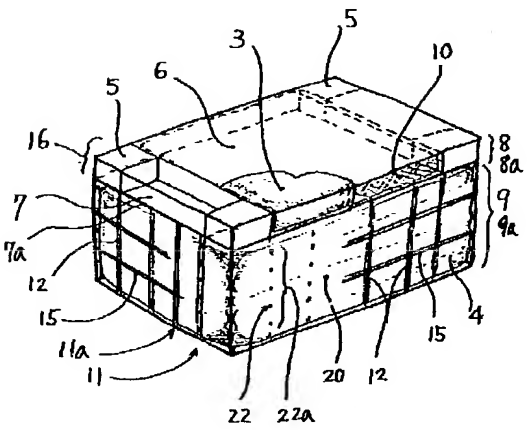
２６　注気パイプ　　２６ａ　注気バルブ　　２７　排気バルブ

２８　放出バルブ　　３１　水圧センサー　　３２　浮力調整制御装置

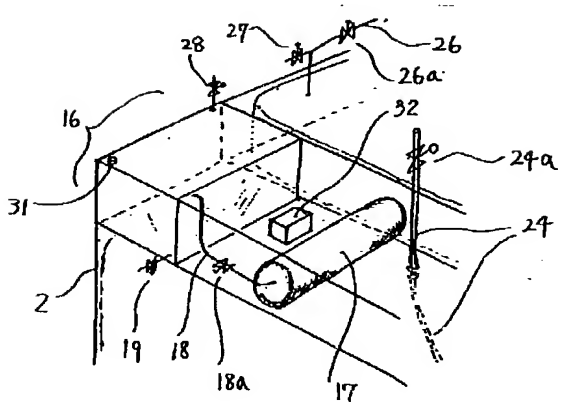
【図１】



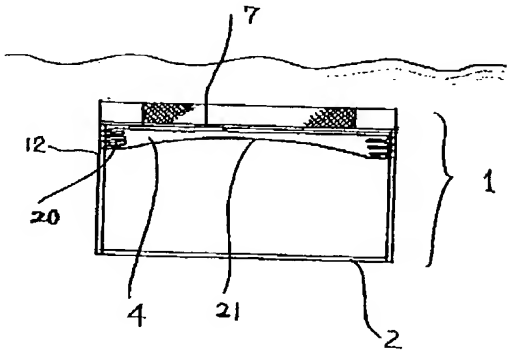
【図２】



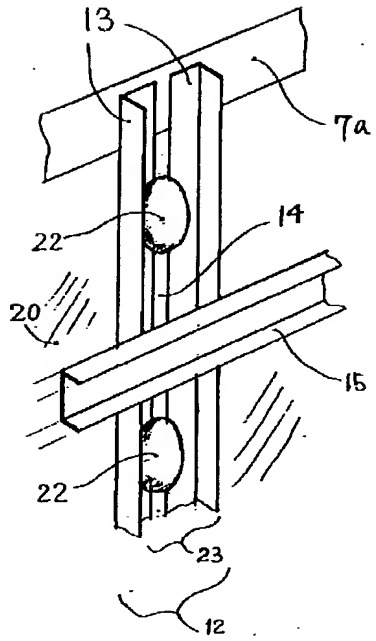
【図４】



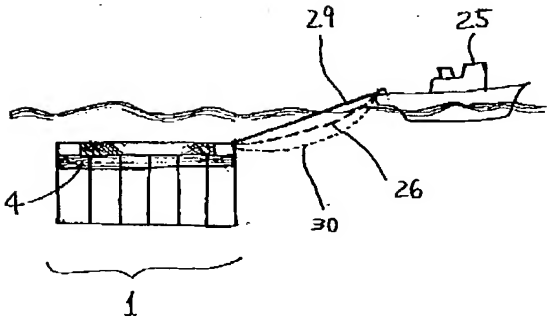
【図５】



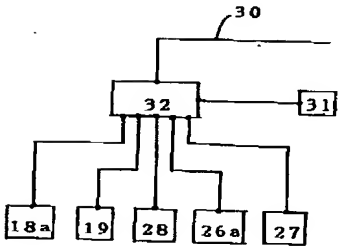
【図3】



【図6】



【図7】



The following is a machine translation of the Japanese Patent JP 07-132881 A

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is the equipment and the mode of transportation which dive in the Japan Current ocean current and convey **** of a large
quantity (tens of thousands of t) to the seaside city in Honshu from Yaku Islands in detail with respect to the equipment of the water transport in the sea.
[0002]
[Description of the Prior Art] Although the so-called Tanggu (water tanker) is used for carrying water in the sea, it is about hundreds of t at most. Although the same
method as a large-sized oil tanker can be considered to carry the water of a lot of low prices of a 10,000t unit between long distances, **** increases and there is a
problem on cost, such as needing operation cost, i.e., a labor cost, and the fuel cost at the time of operation.
[0003]
[Problem(s) to be Solved by the Invention] This invention is offering the approach of consisting of equipment which carries water in large quantities and cheaply,
without diving into an ocean current (Japan Current) in the state of a full-load burden, and using a promotion power plant, and this equipment and tugboat.
[0004]
[Means for Solving the Problem] The elasticity buoyancy tank and the rigid balance tank of variable capacity kept in a frame-structure object and this internal upper part,

It constitutes from the elasticity cargo tank, a cargo work facility, ballasting-up control unit (a **** tank and a water pressure sensor are included), and communication
link signalling device of the variable capacity restored to the internal lower part. Usually The buoyancy of the cargo tank of a loading condition, or the buoyancy tank of
notes gaseous state voice, A **-like condition is held by the buoyancy of a balance tank, and diving and surfacing by the unloaded state and the loading condition are
performed by adjustment of the buoyancy of a balance tank, It is the diving type tank barge which performs performing **** of the ballasting-up to a tank from the
tugboat for ****, and adjustment **** to a balance tank from a **** tank. The rope for **** from DAGUBOTO and a **** pipe equipped with air feeding equipment
etc., It is the mode of transportation by the diving type tank barge with which a tugboat carries out bringing a ship **** of the tank barge with which impregnation of air
etc. was possible to control of a barge, i.e., a buoyancy tank, and it dived into the ocean current, moved [it has tied by the signal, a power line, etc., and] to it at the time
of loading, and dived also at the time of an empty load.

[0005]

[Function] In the tank barge of the above configurations, at the time of the empty load with which the water which is a cargo is not contained in the cargo tank, the
elasticity cargo tank is contracted and the sum total of ****** buoyancy and the proper buoyancy of the configuration member of a barge itself will be in the **-like
condition of balancing with a barge self-weight and floating on a sea surface at the air in a buoyancy tank and a balance tank.

[0006] About what deducted the proper buoyancy of the barge itself from the barge self-weight, it is enlarging sum total buoyancy of a buoyancy tank and a balance
tank, and a barge will be in a **-like condition from an appearance self-weight (below, with a self-weight, it sees and a self-weight is ****(ed)), then this self-weight on a
sea surface.

[0007] In the case of the cargo work who loads a barge with water, it takes to the irrigation (cargo) to a water tank, and the tank is elongated and expanded to down.
Buoyancy arises in coincidence because of the small specific gravity difference (about 0.03) of seawater and the water which is a load. And this big cargo buoyancy and
a small buoyancy of a balance tank balance with the self-weight of a barge mostly, and it can be made to carry out to the sea surface in the loaded condition the shape of
** of them. Since this is that cargo buoyancy can perform subrogation of the buoyancy of a buoyancy tank at the time of a full load, therefore becomes excessive [the
buoyancy of a buoyancy tank] and diving is barred, the air in a buoyancy tank will be emitted.

[0008] And by reducing the air content of a balance tank, i.e., buoyancy, he sinks the full-load barge of a **-like condition into about 30m under a sea surface, and leaves it to an ocean current as it is. There is no power plant for promotion and it is fuel needlessness. If this depth of water is held, the collision with the ship which navigates on [the sea] is [nothing] and is safe. If it arrives at the target seaside city adjacent-seas region, it will be timer automatic actuation or actuation of the ballasting-up control device by the operator guidance from a tugboat, namely, air will be risen to surface from a high ****** tank on the increase of delivery buoyancy, and a sea surface to a balance tank. since air is furthermore fulfilled from a tugboat also to a buoyancy tank and buoyancy is added -- cargo work -- that is, water is pumped up.

[0009] After pumping termination, a barge will be in an unloaded state, loses cargo buoyancy, and it is carrying out the shape of ** by the buoyancy of a buoyancy tank and a balance tank. This tank barge is again sunk into 5m or less under a sea surface by emitting air in part from a balance tank. it is alike, and it follows, and although the volume of the buoyancy tank by the sinking water pressure increasing, i.e., buoyancy, decreases, in order to prevent this, by actuation of a ballasting-up control device, air is poured into a buoyancy tank with a **** pipe from a tugboat also at this time, it heightens the pressure in a tank, and holds that volume (buoyancy) to about 1 law henceforth. And the empty load barge which dived is ****(ed) from marine to Yaku Islands whose tugboat is the source of a stream. Henceforth, they are insurance, the equipment which conveys water cheaply, and a system in the repeat of the same actuation.

[0010]

[Example] Hereafter, the diving type tank barge and space transportation system of this invention are based and explained in drawing 1 - 7 Fig. Like drawing 1 , the diving type tank barge 1 uses the frame-structure object 2, steel flexible elasticity buoyancy tank 3 and elasticity cargo tank 4, and the steel rigid balance tank 5 as a basic component.

[0011] Like drawing 2 , the framework object 2 is the rahmen brace type structure which makes the shape of a rectangular parallelepiped with steel materials. The upper flat surface 6 is constituted from shape steel, a perforated steel plate, a brace, etc., further, a certain spacing is set to this upper flat-surface down side, the same medium-rise flat surface 7 is in it, and the frame-structure object 2 is divided into it in the up space 8 and the lower space 9. To up peripheral face 8a of this framework object 2, receipts and payments of a ********** cage, therefore the seawater to the interior have the free reticulated facing 10. Two or more tank guides 12 which set proper horizontal spacing and are joined in the shape of a vertical between the medium-rise flat surface 7 and level periphery frame material 11a of a pars basilaris ossis

occipitalis 11 are located in a line with lower peripheral face 9a in parallel. A pars basilaris ossis occipitalis 11 constitutes a grid-like flat surface from shape steel etc., and reinforces it with a brace etc.

[0012] Like drawing 3 , this tank guide 12 detaches two shape steel 13 between areoles in parallel, arranges it in the shape of [of KO] a character symmetrically, turns the side containing 14 between areoles inside a framework object, and is joined to medium-rise level frame material 7a and pars-basilaris-ossis-occipitalis level frame material 11a as mentioned above. Many sets of such tank guides 12 are located in a line with a vertical in parallel at horizontal spacing proper to lower peripheral face 9a of a framework object. And how many step thing horizontal reinforcement member 15 is joined by the outside of these tank guide 12 at proper spacing (drawing 2).

[0013] As shown in drawing 2 , the flat buoyancy tank 3 occupies the great portion of up space 8 of the frame-structure object 2 constituted in this way, and the rigid balance tank 5 of small capacity occupies the four corner sections 16 of four corners of this space, i.e., the barge upper part. As shown in drawing 4 , the connection pipe 18 and air bulb 18a which connect this balance tank to the high ****** tank 17, and the seawater bulb 19 by which seawater goes in and out are attached.

[0014] The cargo tank 4 is restored to the lower space 9. This tank is made from the film of plastics or rubber, if it is elastic in flexible and the vertical direction and air or water is filled, it will extend, and it becomes rectangular parallelepiped-like.

[0015] The train of nothing and this projection is located in a line with the periphery side face 20 of the cargo tank 4 in parallel in a train in the vertical direction at spacing with the proper ellipse ball-like projection 22. This projection train 22a is engaged so that it may slide in said tank guide 12 and vertical direction, respectively. (Drawing 3)

That is, it will be suppressed that projection train 22a is restored to the crevice 23 in a guide of the shape of a character of KO, and does not escape from a clearance 14, and the Tanggu wall separates from a guide 12. Telescopic motion of the vertical direction of a cargo tank will be performed freely by this, the periphery side face 20 will break and lap inside at the time of empty, and the base 21 approaches and contracts from the bottom at the medium-rise flat surface 7, and becomes flat [-like] (drawing 5). Moreover, irregular deformation (projecting recessus) is prevented at the time of irrigation and pumping, or migration and NAV. and an air space thin on the tank base 21 in order to contract a cargo tank more smoothly -- < -- it is also good not to illustrate, but to attach >, and to push and lift a tank base by this buoyancy.

[0016] Moreover, the cargo tank 4 is in the medium-rise flat surface and contact condition of a framework object, and firmly, junction is not carried out and it is connected

through the flexible notes column pipe 24 and notes pumping bulb 24a. (Drawing 4)

[0017] As shown in drawing 6 , the tank barge 1 made into the above basic structures pours air into the big buoyancy tank 3 through the **** pipe 26 from the tugboat 25 equipped with air feeding equipment, and inflating valve 26a at the time of an empty load, **** it from the high ****** tank 17 on the small balance tank 5 (drawing 4), and it is changed into the **-like condition of appear at sea by make such buoyancy larger than a self-weight. In addition, as for the high ****** tank 17, it fills up with high-pressure air from the tugboat before diving. The water which is a cargo will be poured into a tank from land through the notes column pipe 24 and notes pumping bulb 24a in this condition.

[0018] Since there is a specific gravity difference of seawater and fresh water abbreviation 0.03, buoyancy is produced along with cargo work (water impregnation). Large buoyancy of the cargo tank 4 in a loaded condition and small buoyancy of the balance tank 5 are made somewhat larger than a barge self-weight. Therefore, in a loaded condition, the buoyancy of a buoyancy tank 3 becomes unnecessary and emits air by the exhaust air bulb 27 (drawing 4). Namely, even if there is no buoyancy of a buoyancy tank 3, the barge of a loaded condition will be in the **-like condition of floating on a sea surface.

[0019] The air of the balance tank 5 is emitted for the full-load barge after cargo work completion by the emission bulb 28, the seawater bulb 19 is opened to coincidence and seawater is introduced into it (drawing 4). That is, it is made to dive to about 30m under a sea surface by reducing buoyancy. These bulbs are closed. And it will move according to an ocean current as it is. If this depth of water is held, the collision with the ship which is hardly influenced of the billow at the time of heavy weather, and navigates on [the sea] is [nothing] and is safe. If it arrives at the target seaside city adjacent-seas region, after the seawater bulb 19 opens air from the high ****** tank 17 to delivery and coincidence through the connection pipe 18 and air bulb 18a to the balance tank 5, and seawater is extruded and increasing buoyancy with timer actuation or the operator guidance from a tugboat, these bulbs will be closed and will surface on a sea surface (drawing 4).

[0020] Since cargo buoyancy decreases and goes when pumping up water from a tank barge through the notes column pipe 24 and notes pumping bulb 24a to land, air is enough poured into a buoyancy tank 3, and pumping is started after gaining the maximum buoyancy. Since a cargo tank is contracted along with pumping and cargo buoyancy is lost after pumping termination, the barge of an unloaded state will be in the **-like condition of floating by the small buoyancy of the balance tank 5, and the big buoyancy of a buoyancy tank 3.

[0021] If emit air by the emission bulb 28 from the balance tank 5, buoyancy will decrease, diving will be started, if the seawater bulb 19 is opened to coincidence and seawater is introduced into it, the burst size of air is adjusted and the seawater bulb 19 is closed in this condition, it will **** in depth of water of 5m or less. In order to prevent the buoyancy of the flexible elasticity buoyancy tank 3 by the water pressure which increases at this time, i.e., reduction of the volume, from DAGUBOTO 25, pour air into a buoyancy tank through the **** pipe 26 and inflating valve 26a, the pressure in a tank is made to balance with that water pressure, that volume (buoyancy) is adjusted almost uniformly henceforth, and depth of water is held.

[0022] The rope (or chain) 29, the signal line and power line 30 for control, and the **** pipe 26 tie to DAGUBOTO 25 before diving (drawing 6), and it is the mode of transportation which **** a tank barge from marine as it is to Yaku Islands which are the source of a stream. The effect of a tidal wave becomes the tank barge which dived with a destabilizing factor, namely, compression of the buoyancy tank 3 with the flexible increment in depth of water and water pressure and buoyancy reduction are brought about by the tidal wave, and much more subsidence of a barge is produced. Also in this case, like the above, air is poured into a buoyancy tank 3 with the **** pipe 26 from DAGUBOTO 25, and buoyancy is held. On the other hand, it has contracted, the cargo tank 4 of water resistance is small, and its fuel consumption is small.

[0023] It carries out to the depth of water of a barge and maintenance of a horizontal position which are diving by the loaded condition by adjusting the air content of each balance tank 5, and equal buoyancy, respectively based on the water pressure which the water pressure sensor 31 of the 4 corner sections 16 of a barge measures.

[0024] Depth of water processes the measurement water pressure of each water pressure sensor 31, and controls it by the watertight pressure resistance ballasting-up control unit 32 which controls closing motion of the air bulb 18 of each balance tank, the emission bulb 28, and the seawater bulb 19 (drawing 4). That is, depth of water is measured by the water pressure sensor 31 which is in four corners at least, and if the tank barge 1 sinks about 30m, it will be automatically sent into the balance tank 5 through the connection pipe 18 and air bulb 18a from the high ****** tank 17. After the seawater bulb 19 opens to coincidence, and seawater is extruded and increasing buoyancy, these bulbs are closed and the depth of water is held (drawing 4). This ballasting-up control device 32 performs closing motion control of all bulbs, and tunes the condition of a barge finely, and the change to the cable from a tugboat or non-wired remote control, and automatic actuation is possible for it. (Drawing 7)

[0025] Moreover, level maintenance of a posture and the effect of a billow will also hold a tank barge horizontally by the ballasting-up control device 32 detecting the inclination of a tank barge, and adjusting the air content of four balance tanks 5 with the difference of the fixed time average value of each water pressure which the water pressure sensor of the 4 corner sections of a barge measures, (drawing 4).

[0026] Maintenance of the depth of water of the barge which is diving with the unloaded state is also the above [0024]. ** -- like -- the air injection to a buoyancy tank 3, and maintenance of a horizontal position -- [0025] It carries out by adjustment of the buoyancy of four balance tanks 5 similarly.

[0027] Although it is the case where one cargo tank is dedicated to a frame-structure object, the above may dedicate two or more cargo tanks, and arranges them in the longitudinal direction of the frame-structure object of an abbreviation rectangle in this case. A tank guide is installed not only between the lower periphery section but between each cargo tank as well as [almost] the above. furthermore, the configuration of a frame-structure object may not be limited in the shape of a rectangular parallelepiped, but the shape of a cylinder and an elliptic cylinder has as it -- < -- these -- not illustrating -- >.

[0028] In addition, although a self-weight becomes large relatively when setting cargo capacity is comparatively small, addition buoyancy is taken into consideration in this case. moreover -- when the setting capacity of a cargo tank is small (thousands of t), there is no substructure (also include a tank guide) of a frame-structure object -- ** -- the case of being good -- **. This is that the self-weight of a barge decreases and consideration of the aforementioned addition buoyancy becomes unnecessary depending on the case.

[0029] The air injection to a buoyancy tank may equip with a snorkel type diesel drive air pump the barge other than the method held from a tugboat. In adjustment of the buoyancy of a balance tank, the method which feeds this air to a high ****** tank, without emitting air all over the sea may be used. Moreover, the method which carries out air injection from a tugboat also to a balance tank is also good. In addition, the detail of many equipments, such as the associated equipment by the side of a tugboat (the remote control of many loading devices of a barge, a communication link, ****, etc.) and buoyancy control, a signal communication link, NAV, cargo work, ****, and mooring, is omitted.

[0030] Moreover, if it should paste up, the buoyancy tank should infiltrate rubber or plastics into the flexible inelasticity ingredient, for example, cloth, and many inside of a tank is divided by the septum of free passage nature, even if it pours air into a buoyancy tank and it pressurizes it, it will serve as an almost fixed flat configuration.

Therefore, even if it pressurizes to the pressure of a more than equivalent to the pressure of a periscope depth range, the configuration and volume of the whole tank are almost fixed. Even if it dives in the state of this pressurization and reaches a schedule periscope depth range, a tank will not be compressed by water pressure, namely, will keep buoyancy constant, and becomes easy to hold fixed depth. In this case, it does not need to pour air into a buoyancy tank from DAGUBOTO, of course.

[0031] Furthermore, even if a buoyancy tank is not necessarily flexible, it is good also as a steel buoyancy tank which hardly transforms the up space where this is settled with water pressure. And this non-FUREKISHIBU tank may be formed in the side face of a frame-structure object, and the outside of a tank guide (submarine method).

However, these tanks also need the bulb for seawater besides the bulb for air.

[0032] To the application relevant to this invention, it is - Japanese Patent Application No. considering a name as "the equipment and the approach" of water transportation. 4-330880 - Japanese Patent Application No. 4-362083 It is.

[0033]

[Effect of the Invention] The diving type tank barge constituted by dedicating the buoyancy tank of variable capacity, four balance tanks, and a cargo tank to a frame-structure object and the building envelope of that holds a lot of water and the fluid-matter, is using an ocean current and can convey a long distance cheaply.

Furthermore, since it moves in the inside of the sea, it bars NAV of other ships and is safe, and since there is little effect of a wave, structure is simple and it is good, construction cost becomes low, and a cargo tank is contracted at the time of an empty load, and it is mode of transportation with the small fuel consumption of bringing a ship **** by the tugboat. Moreover, this barge can also be used as storage equipment of water, or a specific gravity about 1 fluid, without moving.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view of the diving type tank barge of this invention.
[Drawing 2] It is the detail perspective view of the diving type tank barge of this invention.
[Drawing 3] It is the tank guide perspective view of the diving type tank barge of this invention.
[Drawing 4] It is the toe detail perspective view of the upper part of the diving type tank barge of this invention.
[Drawing 5] It is the contraction condition sectional view of the cargo tank of the diving type tank barge of this invention.
[Drawing 6] Diving **** and the migration situation of the unloaded state of the diving type tank barge mode of transportation of this invention and a loaded condition are shown.
[Drawing 7] It is the control related Fig. of the diving type tank barge of this invention.
[Description of Notations]
1 Diving Type Tank Barge 2 Frame-Structure Object 3 Buoyancy Tank
4 Cargo Tank 5 Balance Tank 12 Tank Guide
17 **** Tank 18 Connection Pipe 18a Air Bulb
19 Seawater Bulb 22 Projection 22a Projection Train 25 Tugboat
26 **** Pipe 26a Inflating Valve 27 Exhaust Air Bulb
28 Emission Bulb 31 Water Pressure Sensor 32 Ballasting-up Control Unit

[Translation done.]